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Developing a Training Model Using Orca (Assistive technology) to Teach IT for Visually Impaired Students

Jayant Mahajan[a] , Asha Nagendra[b] *

[a]*Research Scholar, Symbiosis International University, Pune*
[b]*Professor, Symbiosis Institute of Management Studies, Pune*

Abstract

With the increasing number of disabled work force working in the corporate sector, Assistive technologies are playing a very important role in training and development. It is necessary now to have new generation of Information Society products and Training Models to train the disabled workforce in an organization, that ensures full access, participation and equality for all the people including the disabled persons; and to implement new and cost-effective solutions for them. By this research, the researcher has developed a training model to impart IT knowledge and skills to visually impaired students. Feedback related to Orca, an open screen reader was collected from its end-users. It was also compared with three different screen readers on 8 different parameters before using it as one of the technology components of the developed training model. The model has been tested successfully to train undergraduate visually impaired students, using both open source and proprietary technology. However to keep the cost of the training process low, the users are advised to use open source technology.

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* Corresponding author. Tel.: +0-000-000-0000 ; fax: +0-000-000-0000 .
E-mail address: mita.mehta@sims.edu

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1. Introduction

There are about 285 million people who are visually impaired worldwide of which 39 million are blind and 246 million have low vision (severe or moderate visual impairment).With 7.8 million blind people in India, India accounts for 20 per cent of the 39 million blind population across the globe, and this is a big number. The reports narrate the sad stories of the quality of life of most of these people. The only solution to improve the quality of life of visually impaired people is education using technology. As per the pilot study conducted, there are no well researched training models to impart training to visually impaired people, which takes in to account the cognition process and learning styles of visually impaired people. Research is required to find out innovative ways in which assistive technology products can be used to impart training for the visually impaired people from various socio economic strata, age and professional backgrounds to add efficiency to their work in the given organization.

2. Literature Review

There are no research papers which talk about a standard systematic way of providing Information technology knowledge and skills to visually impaired students. Besides, price of the proprietary technology is very high for an average Indian customer.

Dr.Rahul De' in year 2009 found that using open source technology like Linux and ORCA is the only hope to bring the cost of the training process down. According to him, if benefits of Assistive technology have to reach the poor students then what is needed are Training Models which are affordable by these recipients. If the benefits of technology have to reach the grass root level, open source technology has to be a part of training process which will bring down the overall cost of imparting knowledge and skills to a visually impaired person at the bottom of the pyramid.

Dr. Marian Pădure, investigated the characteristics of learning styles in the case of visually impaired persons. The approach of learning style was based on how information is used, on the strategies and learning models, motivation and progress in learning. He focused on the influence of the assistive technologies and on the shaping of an optimal learning style. His results offer not only a global and a particular image of the learning style of the persons with visual impairments but also some explanation regarding the relationship between them and assistive technologies. He stated that cognitive styles influence the learning styles and learning styles can be improved by practice, depending on the experience. Being aware of a particular learning style presence represents a premise of his development and optimization for a better control of the conditions from the immediate or remote reality and the adjustment to environment. Although the use of assistive technology for young children is increasing, the lack of training and awareness continue to act as major barriers to providers using assistive technology.

3. Research Methodology

3.1. Research Objectives

The main objective of the research was to develop a training model for imparting basic IT skills to visually impaired students. To fulfill the primary objective, the secondary objectives were:

i. To conduct an opinion survey related to Orca, an open source screen reader used by:
   - Visually impaired students who are learning to use various software using Orca screen reader
   - Teachers who teach visually impaired students how to use computers using Orca Screen reader
   - Heads of the institutions of the schools of visually impaired students who are the decision makers for the choice of technology

ii. To conduct a comparative study of Orca with three other popular screen readers such as Jaws, Voice Over and NVDA

iii. To conduct an experiment to test the effectiveness and efficiency of the model developed by the researcher

To reach these objectives, it was necessary to:

a) Collect data onthe type of software being used currently by visually impaired students
b) Conduct a comparative study of Orca Screen Reader with similar other Screen Readers
c) Conduct an experiment where the model was tried on the treatment group and the results were compared with the control group.

3.2. Variables related to the study

For the purpose of the experiment, the chosen students and teachers were divided into control group and treatment group. The students in the control group were taught using the regular trial and error method by a teacher who was not trained to use the proposed model. In the case of the treatment group, the students were taught using the proposed training model by the teacher who was trained to use the training model.

The aim of the researcher was to study the effect of the proposed training model on the test scores of the students who belong to the treatment group. Hence the two variables which have been identified are **Training model** and **Test scores** of the student. The profile of students for the purpose of this experiment consisted of following parameters:

- Prior knowledge of computers
- Age group
- Average score in 12^{th} Standard

The profile of the teacher for the purpose of this experiment consisted of following parameters:

- Qualification of teacher
- Training
- Number of years of experience

3.3. Sample and Sampling Techniques

For collecting feedback from the end users of Orca:

A combination of Cluster, Stratified, Quota and Convenient random sampling method were used to collect feedback from the end users of Orca. The institutions where Orca screen reader is used by the visually impaired students were identified. Convenient random sampling method was used to select the heads of the institutions, teachers and students for the survey based on availability and willingness to participate in the survey. The schools for visually impaired people across India were stratified into two broad strata.

1. The schools using Orca to impart IT skills to visually impaired students and
2. The schools using any other technology other than Orca to impart IT skills to visually impaired students.

Government schools for visually impaired people in Kerala and Pune were the two clusters which were identified where there were a significant number of users using Orca to use computers.

The Heads of Institutions, teachers and students from the 1st strata of school i.e. schools using Orca to impart IT skills to visually impaired students were selected for the purpose of the survey using a convenient random sampling method within that strata.

4. Data Collection techniques

Primary Data for opinion survey

Interview Schedules were used to collect primary data from Heads of Institutes, teachers and students. And the Observation Method was used to see how visually impaired students learn computers in the schools.The researcher conducted interviews personally with 10 Heads of institutes, 12 teachers and 26 students. Some interviews were conducted over the telephone and Skype video calling facility while some were conducted personally.

Primary data collection for the comparative study of screen readers

An interview schedule was used to collect primary data from the experts. The interview schedule consisted of open ended questions. The Observation Method was used to study the screen reader characteristics by the researcher. Data is represented using a simple table and inference was drawn applying simple logic.

Primary data collection for developing of training model and experimentally testing the same:

Experts were identified and consulted to understand the details of developing a training model that can be used to teach abstract concepts as well as skills which normally need visual inputs.Convenient random sampling method was used to choose three experts from each of these strata and their expertise was used to develop the training model.The methodology used to identify the components for a Training Model was through expert opinion. The experts were from the field of education and assistive technology. This model which has been developed by the researcher has been tested for teaching both categories of the topics for the students in the control and treatment group.

The topics chosen to be taught using the training model were:Computer fundamentals, Graphical User Interface (GUI) Concepts, File Managerand Word processor.

Topic 'Computer fundamentals' is abstract in nature; whereas other topics generally require visual inputs. The topics have been chosen with a view that this model can be tested effectively for its ability to impart training related to both abstract concepts and topics that generally require visual inputs.

5. Points of Observation throughout the Experiment

1. Rating given by the teachers for their teaching experience on the scale of 1 to 10.
2. Rating given by the students for their learning experience on the scale of 1 to 10.
3. Attendance of the student during the course.
4. Module test scores and final test scores.

These observations were recorded in a tabular form and used for further analysis.

The effectiveness of the Training Model was tested on two groups. The composition of the groups is described as follows:

10 visually impaired students were chosen as per the following profile:

i. Age group: 17 to 18 years
ii. Education Qualification: enrolled 1st year of graduation 1st semester.
iii. Knowledge of computers: Nil.
iv. Blindness acquired: By birth

The students were randomly chosen from various disciplines such as Science, Arts and Commerce. They were divided into two groups of five each. 1 teacher randomly was assigned to each group. The teachers chosen had 1.5 years of experience in teaching Information Technology to visually impaired students.One group underwent the training with the training model (Treatment group) and the other group underwent the training without using training model i.e. the trial and error method (Control group). The teacher of the Treatment group underwent a 4 hours course on using the Training Model.

6. Conclusions

In the light of findings of opinion survey of Head of the Institutions, Teachers and the Students, the researcher concludes that although there is a significant amount of research available to impart knowledge and skills in other subjects like, Science, Mathematics, History, Geography, Languages etc... . However, there is very little research being done to impart knowledge related to teaching IT skills to visually impaired students. Teachers follow more of a 'trial and error' method and not a standard researched training model. They do not consciously take into consideration the learning styles and cognition process of a visually impaired student while imparting IT knowledge and skills to them. However, they agreed that different students have different learning styles; therefore, it will be helpful to provide a researched method to handle students with different learning styles.

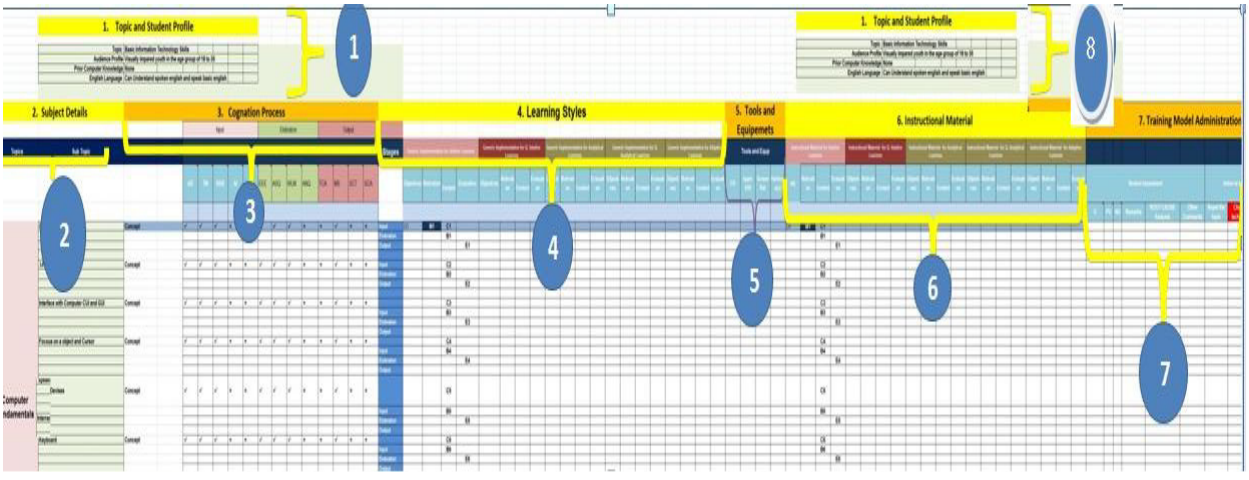
Teachers in Pune use JAWS and Windows while teachers in Kerala use Orca, LINUX and Open Office. The reason cited for the difference in usage is that the Maharashtra government is more pro Windows and the government in Kerala is more pro open source technology. State policies do influence the usage of operating system and related technology. Teachers further felt that Orca is at par with JAWS.

As per the findings of the opinion survey and comparative study, Orca is as good as JAWS or NVDA and other screen readers in terms of its capabilities and features except for the limitations like Poor voice quality, Non user friendly technical Support and Inadequate availability of documentation and online help.

However, they said that, many NGOs are working together to solve the problem of technical support and availability of help and documentation

Highlights of the Training Model Developed by the researcher

Figure 1: Snapshot of components of the training model



The eight components of the training model are Student Profile, Topics to be taught, Cognition process which consists of three stages, Generic Contents for every Learning Styles, Tools and Equipment, Instructional Material specific to the given learning style and technology, Administering the training model and certified teacher. For the first time, a training model has been developed to impart IT skills to visually impaired students, considering their learning styles and the cognition. Use of this model will help the facilitator / teacher of Information Technology to:

Using this model will help the facilitator of Information technology to:

i. Walk in the class and circulate a questionnaire which has questions which will help the teacher to determine the personality of the student.
ii. Map the answers collected from the students to the score sheet
iii. Identify the learning styles of the student, based on the answers
iv. Identify the configuration of the class in terms of learning styles
v. Identify the right set / combination of instructional material
vi. Conduct a successful class
vii. Administer the model

Results of the Experiment in Pune University using Open Source Technology

The profiles of the groups were as follows:

Profile of Treatment group

a. Profile of Students

Number of students = 5, Age: 17 to 18 years, Prior knowledge of computers: only How to start and shutdown computers and simple internet browsing skills, Average Score in 12th Standard: 60.5%, Stream chosen for HSc : 2 students from commerce stream ; 3 students Arts stream

b. Profile of Teacher

Qualification of teacher - BCom and Diploma in Computers, Training: Trained to use the Proposed Training Model, Number of years of experience: 2 years

Profile of the Control Group

a. Profile of students

Number of students = 5, Age: 17 to 18 years, Prior knowledge of computers: How to start and shutdown computers and simple internet browsing skills, Average Score in 12th Standard: 58%Stream chosen for HSc: 4 students, from commerce stream, 1 students from Arts stream

b. Profile of Teacher

Qualification of teacher, BA, B.Ed. and Diploma in Computers, Training: No training was provided related to the Training Model, Number of years of experience: 2.2 years, Duration of experiment / course: 50 hours (5 hours daily) for 10 days

7. Analysis of the data

Table 1: Average test scores of Control Group and treatment group in Experiment

	Average Attendance	Average Student Rating	Average Module test scores	Average Final Exam Scores	Average Teachers Rating	Total Duration Allocated	Actual Duration
Control Group	100	7.5	54	57.5	10	50	50
Treatement Group	100	8.75	67.5	74.25	10	50	45

There were two sets of respondents. The first set consisted of the respondents who were taught without using the training model and the second set consisted of the respondents who were taught basic IT skills course without using the training model.

They were subjected to a test after the completion of each module test followed by a final test.

The average test scores of both the respondents were recorded. The two sets of respondents did not differ in any way other than exposure to the training model. The researcher was interested in finding out whether the average test scores of these groups differed significantly.

As seen in Table1, the attendance for both the groups was 100%. The average student rating for satisfaction level on a scale of 1 to 10 for the Control Group was 7.5 and for the Treatment Group it was 8.75. Satisfaction level of teachers of both the groups was 10. It can be see that the test scores of module test and the final test score of the Treatment Group is higher than the Control Group. The time taken by the Treatment group is 5 hours less than the allocated time, whereas the Control Group finished the course in exactly the allocated time. This indicated that the model is effective and efficient.

Statistical Analysis:

H_0: There is no significant difference between the average test scores of the students of control group and the

treatment group

H_1: There is a significant difference between the average test scores of the students of control group and the treatment group

The Student Paired T-test was thought to be the most appropriate for finding the difference in the mean scores of the control group and the treatment group. The test score for the above mentioned parameters was obtained and recorded by the researcher.

Table 2: Student Paired T- test

Student T-Test									
Comments									
Input	N of Rows in Working Data File	20							
Missing Value Handling	Definition of Missing	User defined missing values are treated as missing.							
	Cases Used	Statistics for each analysis are based on the cases with no missing or out-of-range data for any variable in the analysis.							
Paired Samples Statistics									
		Mean	N	Std. Deviation	Std. Error Mean				
Pair 1	s_1	52.8500	20	6.97571	1.55982				
	s_2	58.3500	20	4.31978	0.96593				
Paired Samples Correlations									
		N	Correlation	Sig.					
Pair 1	s_1 & s_2	20	0.646	0.002					
Paired Samples Test									
		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	s_1 - s_2	-5.50000	5.32620	1.19097	-7.99274	-3.00726	-4.618	19	0.000

Paired Sample Statistics

t Value = - 4.618 with p value 0.001 with a division of 5 % level of significance and alpha = 0.05. The p value is < 0.05.There is a significant difference between the test scores of the students from the Control and the treatment groups. Thus the hypothesis H1'There is a significant difference between the average test scores of the students of control group and the treatment group' has been accepted

It was found that there is a significant difference in the average test scores. This means that the average test scores of the students of the Treatment Group are higher than the scores of the students in the Control Group. The above results are in agreement with the findings of Dr. Marian Padure who in year 2012 found that when one takes into account the learning styles of the students while teaching, they tend to learn better. The findings of the opinion survey collected are also in agreement with the results of Dr. Rahul De' from IIM Bangalore who in 2009 found that using open source technology one can impart equally or even more effective training with low cost.

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